

Innovative Vitrification Technology For Soil Remediation

James G. Hnat, Ph.D. (mschaffer@earthlink.net; 610-489-2255)

John S. Patten, Ph.D. (mschaffer@earthlink.net; 610-489-2255)

Norman W. Jetta, P.E. (mschaffer@earthlink.net; 610-489-2255)

Vortec Corporation
3770 Ridge Pike
Collegeville, PA 19426

Abstract

Vortec has successfully completed Phases 1 and 2 of a technology demonstration program for an “Innovative Fossil Fuel Fired Vitrification Technology for Soil Remediation.”¹

The principal objective of the program is to demonstrate the ability of a Vortec Cyclone Melting System (CMS™) to remediate DOE contaminated soils and other waste forms containing RCRA hazardous materials, low levels of radionuclides and TSCA (PCB) containing wastes. The demonstration program will verify the ability of this vitrification process to produce a chemically stable glass final waste form which passes both TCLP and PCT quality control requirements, while meeting all federal and state emission control regulations. The demonstration system is designed to process 36 ton/day of as-received drummed or bulk wastes. The processing capacity equates to approximately 160 barrels/day of waste materials containing 30% moisture at an average weight of 450 lbs./barrel.

The basic components of the CMS™ are a counter-rotating vortex (CRV) preheater/oxidizer, a cyclone melter and a glass product reservoir. The balance of the plant consists of feed preparation and blending, product handling, heat recovery, air pollution control, and waste water treatment subsystems.

A conceptual design of the demonstration plant and pilot scale feasibility testing were completed in 1993 during Phase 1 of the program. The definitive plant design and waste form qualification tests using a 15 ton/day pilot scale system were completed in Phase 2 in 1995. The construction and operational phase of the demonstration program (Phase 3) was initiated in late January of 1996 and is scheduled to be complete by the second Quarter of 1999.

The Vortec CMS™ has demonstrated the ability to vitrify typical DOE site solids, spiked with surrogate radionuclides, heavy metals, and PCB's. The glass final waste form has consistently passed the TCLP tests for the leachability in pilot plant operations. The Vortec CMS™ has successfully processed over 35,000 pounds of surrogate materials representative of contaminated soils found at the DOE-Hanford site and DOE-Paducah sites during Phase 1 and 2 of the program. The samples taken during the tests confirmed that virtually all of the radionuclide

¹ Project sponsored by U.S. Department of Energy's Federal Energy Technology Center, under Contract DE-AC21-92MC29120 with Vortec Corporation, Collegeville, PA

surrogates in the vitrified product were retained and did not leach to the environment. The organic material stimulants, anthracene and dichlorobenzene were destroyed during the pilot tests with a Destruction and Removal Efficiency (DRE) of at least 99.9%. RCRA metals that were in the vitrified product were retained and did not leach to the environment as confirmed by the TCLP testing.

Phase 3 of the program, leading to the plant construction and demonstration test at Paducah, is approximately 50% complete. The air permit required by the State of Kentucky has been issued. The public comment period associated with the issuing of an RCRA RD&D permit was closed on October 2, 1996. Construction has been initiated and the formal site dedication ceremony was held October 16, 1996. However, the state of Kentucky has requested DOE to resubmit the air permit to align the air permit and RD&D permit emission requirements.

DOE has recently initiated an environmental assessment (EA) investigation that is scheduled for completion by January 1, 1998. Plant assembly will be initiated after approval of the EA.

The demonstration tests at Paducah will be performed with drummed mixed RCRA/LLW and TSCA/LLW waste containing contaminated soils and mud with up to 30% moisture. Sampling of the drums to be processed indicates that wastes will also contain construction and other debris such as reinforced concrete. The estimated cost of processing the contaminated wastes is projected to be in the range of \$50 to \$100 per barrel for drummed wastes and \$100 to \$200 per ton for bulk wastes. The flexibility and the low processing cost of the process offer the potential for significant environmental and operational improvements and substantial cost savings over landfilling and alternative thermal treatment technologies.

Acknowledgment

The period of performance of the contract is March 1993 to January 1998. Project sponsored by U.S. Department of Energy's Federal Energy Technology Center under contract DE-AC21-92MC29120 with Vortec Corporation. The authors wish to acknowledge the contributions of DOE-FETC COR, Mr. Cliff Carpenter.